

THE CLAIMS

What is claimed is:

1. A gas reclamation system for capturing volatile organic compounds from an effluent of a semiconductor manufacturing operation, said system comprising:

a reversible capture unit arranged to capture volatile organic compounds from the effluent and to selectively release the captured volatile organic compounds in concentrated form, wherein the reversible capture unit comprises a physical adsorbent having a selective sorptive affinity for the volatile organic compounds; and

a vacuum desorption unit arranged to desorb volatile organic compounds from the adsorbent in concentrated form.

2. The gas reclamation system of claim 1, wherein the physical adsorbent is present in a physical adsorbent bed in an adsorber vessel.

3. The gas reclamation system of claim 1, wherein the physical adsorbent is present in a multiplicity of inter-manifolded physical adsorbent beds arranged for cyclic adsorption/desorption operation involving contacting of the effluent to effect adsorption of volatile organic compounds, and subsequent desorption of the volatile organic compounds, wherein each of the inter-manifolded physical adsorbent beds is arranged to operate in accordance with a predetermined cycle time program involving concurrently at least one on-stream physical adsorbent bed engaged in said contacting and at least one off-stream physical adsorbent bed engaged in said desorption of the volatile organic compounds.

4. The gas reclamation system of claim 1, wherein the vacuum desorption unit maximizes the fuel value of the desorbed volatile organic compounds.

5. The gas reclamation system of claim 1, wherein the pressure of the vacuum desorption unit does not exceed about 700 Torr.

6. The gas reclamation system of claim 1, further comprising a power generator arranged to receive the captured volatile organic compounds to generate electricity.

7. The gas reclamation system of claim 6, wherein the power generator comprises a gas turbine engine.

8. The gas reclamation system of claim 7, wherein the gas turbine engine is a microturbine.

9. The gas reclamation system of claim 8, wherein the microturbine generates about 30 kW to about 60 kW of power.

10. The gas reclamation system of claim 7, further comprising a combustion promoting gas unit arranged to provide the combustion promoting gas to the gas turbine engine.

11. The gas reclamation system of claim 10, wherein the combustion promoting gases comprise oxygen.

12. The gas reclamation system of claim 7, wherein the captured volatile organic compounds undergo combustion in the gas turbine engine.

13. The gas reclamation system of claim 7, further comprising a combustion sustaining fuel unit arranged to provide the combustion sustaining fuel to the gas turbine engine.

14. The gas reclamation system of claim 13, wherein the combustion sustaining fuel comprises a fuel species selected from the group consisting of hydrogen, natural gas and C₁-C₄ alkanes.

15. The gas reclamation system of claim 1, wherein a vacuum pump is disposed upstream of the power generator.

16. The gas reclamation system of claim 1, coupled in effluent receiving relationship to a semiconductor manufacturing process.

17. The gas reclamation process of claim 16, wherein said semiconductor manufacturing process comprises a process selected from the group consisting of photoresist spin coating, isopropanol dryers, wet bench photoresist strip tools, solvent baths, solvent washing stations and combinations of two or more of the foregoing.

18. The gas reclamation process of claim 1, wherein the captured volatile organic compounds comprise a compound selected from the group consisting of saturated hydrocarbons, unsaturated hydrocarbons, aromatic hydrocarbons, esters, ethers, oxygen-containing acids, amines, mercaptans, thioethers, and halogen-containing hydrocarbons.

19. The gas reclamation system of claim 1, wherein the captured volatile organic compounds comprise a compound selected from the group consisting of isopropanol, ethylacetate, acetone, propylene glycol monomethyl ether acetate (PGMEA) and hexamethyldisilazane (HMDA).

20. The gas reclamation system of claim 2, wherein the adsorbent bed(s) comprise a carbon sorbent material.

21. The gas reclamation system of claim 2, wherein the adsorbent bed(s) comprise a non-carbon sorbent material.

22. The gas reclamation system of claim 1, wherein the disposition of the captured volatile organic compounds is selected from the group consisting of cogeneration, condensation using a cold trap, purification, filling gas and dispensing vessels and destruction in a centralized abatement unit.

23. A gas reclamation system for capturing volatile organic compounds from an effluent of a semiconductor manufacturing process for cogeneration, said system comprising a physical adsorption unit including at least one adsorber vessel containing a physical adsorbent having selective sorptive affinity for the volatile organic compounds, wherein the physical adsorption unit is arranged to receive effluent containing volatile organic compounds, for selective adsorption of volatile organic compounds on adsorbent therein, and to subsequently desorb volatile organic compounds from the physical adsorption unit; and a power generator coupled to the physical adsorption unit and arranged for receiving a desorbate at least partially concentrated in volatile organic compounds from the physical adsorption unit to generate electricity.

24. The gas reclamation system of claim 23, wherein the power generator comprises a gas turbine engine.

25. The gas reclamation system of claim 23, wherein the volatile organic compounds are desorbed from the physical adsorption unit using a vacuum.

26. A process for improving the efficiency of abatement and/or implementing reclamation and concentration of volatile organic compounds in an effluent of a semiconductor manufacturing process, said process comprising:

capturing the volatile organic compounds from said effluent in concentrated form, wherein the capturing step comprises use of adsorbent bed(s) for capture of the volatile organic compounds; and

releasing the adsorbed volatile organic compounds by vacuum desorption.

27. The process of claim 26, wherein the adsorbent bed(s) comprise a non-carbon sorbent material.

28. The process of claim 26, wherein the adsorbent bed(s) comprise a carbon sorbent material.

29. The process of claim 26, further comprising generating electricity wherein the released volatile organic compounds are directed to a power generator.

30. The process of claim 26, further comprising condensing the released volatile organic compounds in a cold trap.

31. The process of claim 29, wherein the power generator comprises a gas turbine engine.

32. The process of claim 31, wherein the gas turbine engine comprises a microturbine.

33. A method of reclamation and cogeneration of volatile organic compounds in an effluent of a semiconductor manufacturing process comprising:

collecting the effluent containing volatile organic compounds;

selectively adsorbing the volatile organic compounds from the effluent at least partially concentrated in the volatile organic compounds on a physical adsorbent therein;

desorbing volatile organic compounds from the adsorbent to produce a stream of captured volatile organic compounds;

combusting the captured volatile organic compounds in a combustor to substantially destroy the captured volatile organic compounds and create a resulting stream of combustion gas;

directing said resulting stream of combustion gas to drive a power generator; and

recovering power from operation of said power generator.

34. The method of claim 33, wherein the physical adsorbent is carbon.

35. The method of claim 33, wherein the volatile organic compounds are desorbed from the adsorbent using a vacuum.